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EXAMINER	
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ART UNIT	**PAPER NUMBER**
2128	

DATE MAILED: 12/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/995,421	CHUNG ET AL.	
	Examiner	Art Unit	
	Kibrom K. Gebresilassie	2128	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *21 October 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-35 have been presented for examination based on applicant's amendment filed on 21 October 2005.

2. Claims 1-35 remains rejected by the examiner.

Response to Arguments

3. Applicants arguments filed on 21 October 2005 have been fully considered.

Regarding applicant's response to objection to the specification: The examiner withdraws the objections to the specification of (i) and (ii) of the previous Office Action in view of applicant's amendment to the specification and argument filed on 21 October 2005.However, the objection of the specification of page 15 table 1 didn't solve the problem by adding a negative sign in front of the number calculated for the percentage error which objected by the examiner. The difference between the calculated value and experimental value of 1500/W/31/150/10 of SiO2 is very huge. The percentage error should be much bigger or much smaller depending on the formula used to calculate the error. Therefore, the examiner does not withdraw the objection of this matter.

Regarding applicant's response to the objection of claims: The examiner withdraws the objection of claim 29 based on the change made by the applicant's.

Regarding applicant's response to 112(2) rejection: The examiner withdraws the 112(2) rejection in view of applicant's argument filed on 21 October 2005.

Regarding applicant's response to 101 rejection: The examiner withdraws the 101 rejection in view of applicant's amendment and argument filed on 21 October 2005.

Regarding applicant's response to 103(a) rejection: Applicant's have argued that the prior art (Arami and Lymberopoulos) are contradicted in stating of claim 1. While applicant's arguments have completely misrepresented the examiner's rejection and

have ignored the fundamental teachings of the cited prior art, the examiner makes the following observation.

Regarding Claim 1: As cited in previous action, Arami clearly discloses a ***reaction chamber (col. 1 line 23), a plasma reactor (col. 5 line 7; fig. 1)*** *and a* ***plurality of magnets (Fig. 2).*** *The prior art of Arami is used to show the limitations specified above. Lymberopoulos clearly discloses generating a* ***model of plasma*** *(page 475, under a title "3. Plasma simulation" lines 1-4) from computed* ***plasma characteristics*** *(page 475, under a title "2. Problem Statement" lines 1-10) for* ***a plurality of cross sections*** *(page 492, left side column, under a title "7. Summary and Outlook", second paragraph).*

Applicant's argued that the teaching of Lymberopoulos does not include " a plurality of magnets that move with respect of to the reaction chamber". However, this limitation is clearly included in the teaching of Amari (See col. 7 lines 18-21; Fig. 2), which can cure the deficiency of the teaching of Lymberopoulos. Furthermore, applicant's argued that the reactor that included in the teaching of Lymberopoulos appears to be a different type than the teaching of Arami. In response, the examiner believes that the reactor mentioned in the invention is clearly disclose in the teaching of Arami. It is therefore one cannot attack show nonobviousness by attacking references individually where the rejection are based on combinations of references. See In re Keller, 642 F. 2d 413, 208 USPQ 871 (CCPA 1981); In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Regarding Claim 28 and 32: The applicant's argued that the prior art does not teach 3-dimenstionally computed static magnetic fields induced by the permanent magnets. In response, the examiner specifically showed this limitation based on the Applicant's Own Admission (AOA) stated as follows: "a 3-dimensional magnetic field induced by the

permanent magnet 102 is computed, ***for example, commercially available software*** *104. For example, a* ***commercial finite element analysis tool*** *such as* ***Vector Fields*** *may be used to determine the 3-dimesional magnetic fields." (See page 6 lines 27-30). Therefore, as clearly shown in the sentence of Applicant's Own Admission, there is commercially available software that can compute 3-dimensional static magnetic field induce by the permanent magnets.*

Regarding Dependent Claim 2: Claim 2 (i.e. the plurality of moving magnets rotate about an axis of rotation) is rendered obvious by Amari at least at col. 6 lines 42-50;and in Fig. 2.

Regarding Dependent Claim 3: Claim 3 (i.e. computing electron density and temperature) is rendered obvious by Lymberopoulos at least at page 481, left side column, lines 20-24, recites "...one obtains a rather complex expression in terms of electron density and temperature, ion density and the species mobility at the wall."; and in Fig. 2 of page 483.

Regarding Dependent Claim 5: Claim 5 (i.e. determining a ***static magnetic field*** *generated by moving magnet) is rendered obvious by Arami at least at Fig. 4.*

Regarding 103(a) rejection motivation to combine: The examiner contends that the motivation to combine Arami and Lymberopoulos and in accordance with MPEP guidelines for the following reasons:

MPEP 2143.01 Suggestion or Motivation To Modify References first recites:

> *"There are three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art." In re Rouffet, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998)"*

Therefore, in suggesting a motivation to combine, the examiner specifically focused his motivation on the knowledge of persons of ordinary skill in the art. More specifically, that a

skilled artisan would have made an effort to become aware of what capabilities had been developed in the market place, and hence would have knowingly modified Amari with the teachings of Lymberopoulos.

MPEP 2144 Sources of Rationale Supporting a Rejection Under 35 U.S.C. 103 recites:

The rationale to modify or combine the prior art does not have to be expressly stated in the prior art; the rationale may be expressly or impliedly contained in the prior art or it may be reasoned from knowledge generally available to one of ordinary skill in the art, established scientific principles, or legal precedent established by prior case law. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). See also In re Kotzab, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000) (setting forth test for implicit teachings); In re Eli Lilly & Co., 902 F.2d 943, 14 USPQ2d 1741 (Fed. Cir. 1990) (discussion of reliance on legal precedent); In re Nilssen, 851 F.2d 1401, 1403, 7 USPQ2d 1500, 1502 (Fed. Cir. 1988) (references do not have to explicitly suggest combining teachings);

Having access to the teachings of Arami and Lymberopoulos, would have looked to the prior art and hence would have knowingly modified the teaching of Arami, with the teachings of Lymberopoulos in order to gain the advantage of reduced cost and development time. Specifically, a skilled artisan working in this obviously competitive environment would have made an effort to become aware of what capabilities had already been developed in the market place, and hence would have been aware of, and known to seek out the relative teachings of the problem to be solved, namely, the teaching of Amari and Lymberopoulos.

For the reasons set forth above the examiner maintains the 103(a) rejection.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art

are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dimitris P. Lymberopoulos and Demetre J. Economou, " Two-Dimensional Self-Consistent Radio Frequency Plasma Simulations Relevant to the Gaseous Electronics Conference RF Reference Cell", Journal of Research of the National Institute of Standards and Technology, Vol. 100, No. 4, July-August 1995 in view of U.S. Patent No. 6,014,943 issued to Arami, and further in view of Applicant's Own Admission, herein referred to as AOA.

As per Claim 1:

Lymberopoulos discloses a method of estimating characteristics of a plasma contained *(page 475, under a title "2. Problem Statement" lines 1-10)*, the method comprising: obtaining configuration and process condition data (page 473, right side column, lines 20-22); computing plasma characteristics *(page 475, under a title "2. Problem Statement" lines 1-10)* for each of a plurality of cross-sections (page 492, under a title " 7 Summary and Outlook", second paragraph) from the configuration and process condition data (page 473, right side column, lines 20-22); and generating a generalized model of the plasma *(page 475, under a title "3. Plasma simulation" lines 1-4)* from the computed plasma characteristics *(page 475, under a title "2. Problem Statement" lines 1-10)* for the plurality of cross-sections (page 492, under a title " 7 Summary and Outlook", second paragraph).

Lymberopoulos fails to disclose a reaction chamber of a plasma reactor including a plurality of magnets that move with respect to the reaction chamber.

Arami discloses a reaction chamber (process chamber; col. 1 line 23) of a plasma reactor (etching device; col. 5 lines 7, Fig. 1) including a plurality of magnets (segment magnets M1-M40; Fig. 2) that move with respect to the reaction chamber (col. 6 lines 49-51);

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to combine the teachings of Lymberopoulos related to computing plasma characteristics and generating of a generalized model of the plasma with the teachings of Arami related to a plurality of magnets that move with respect to the reaction chamber and for each plurality of cross sections of the reaction chamber. The motivation for doing so would have been more convenient for generating a magnetic field having a magnetic line of force in the plasma generating area, so that the plasma of the process gas is generated in the plasma generating area (Abstract). Hence a skilled artisan having access to the teaching of Lymberopoulos and Arami would have knowingly modified the teaching of Lymberopoulos with Arami.

As per Claim 2:

Arami discloses the plurality of moving magnets rotate about an axis of rotation (col. 6 lines 42-45), and wherein each of the plurality of cross-sections includes the axis of rotation (col. 2 lines 35-36; col. 6 lines 42-45; Fig. 2).

As per Claim 3:

Lymberopoulos discloses computing electron density and temperature (electron density and temperature; page 481, left hand side column, a paragraph starting with "Combining Eq. (36) with..." lines 3-4) for the cross-section using an iterative Monte Carlo computational procedure (page 475, right hand side column, a paragraph starting with " There are three kinds ..." line 9); and

computing ion and neutral species transmission phenomena (page 482, right hand side column, paragraph two, lines 1-3) for the cross-section from a plasma dynamics simulation (plasma simulation, which in turn provide insight into plasma dynamics; page 473, right hand side column, last line of a paragraph and continue the first line of page 474).

As per Claim 4:

Lymberopoulos discloses computing the ion and neutral species transmission phenomena for the cross-section from a plasma dynamics simulation comprises computing solutions to a continuity equation and Poisson's equation for the ion and neutral species (page 483, left hand side column, a paragraph starting with " In order to decouple..." lines 6-10).

As per Claim 5:

Lymberopoulos discloses computing the plasma characteristics for each of the plurality of cross sections from determined shape information (anisotropy (shape of microscopic features etched into the wafer); page 475, left hand side column, under a title "**2. Problem Statement**" lines 12-13) for the reaction chamber, and plasma collision reaction data (page 474, right hand side column, last paragraph, lines 3-7).

Lymberopoulos fails to disclose static magnetic fields.

Arami discloses static magnetic field (col. 1 lines 30-35; Fig. 4)

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to combine the teachings of Lymberopoulos related to computing plasma characteristics and generating of a generalized model of the plasma with the teachings of Arami related to a plurality of magnets that move with respect to the reaction chamber and for each plurality of cross sections of the reaction chamber. The motivation for doing so would have been more convenient for generating a magnetic field having a magnetic line of force in the plasma generating area, so that the plasma of the process gas is generated in the plasma generating

area (Abstract). Hence a skilled artisan having access to the teaching of Lymberopoulos and Arami would have knowingly modified the teaching of Lymberopoulos with Arami.

As per Claim 6:

Lymberopoulos discloses generating a generalized model of the plasma from the computed plasma characteristics for the plurality of cross-sections comprises computing at least one of an electron density distribution, a temperature distribution, a distribution of ion species, a distribution of neutral species, and a flux incidence (page 475, right hand side column, under a title "**2. Problem Statement**" lines 4-10).

As per Claim 7:

Lymberopoulos discloses generating a generalized model of the plasma from the computed plasma characteristics for the plurality of cross-sections comprises averaging the computed plasma characteristics for each of the plurality of cross-sections (page 475, left hand side column, under a title " **2. Problem Statement**" lines 16-17).

As per Claim 8:

Lymberopoulos discloses estimating an etching rate for a wafer positioned in the chamber from the generalized model of the plasma (page 475, left hand side column, under a title " **2. Problem Statement**" lines 10-12).

As per Claim 9:

Arami discloses a dipole ring magnet (DRM) plasma reactor (a plasma generation device having a dipole ring magnet; col. 1 lines 26-27).

As per Claims 10 and 19:

The limitations of Claims10 and 19 have already been discussed in the rejection of Claim 1. They are therefore rejected under the same rationale.

As per Claims 11 and 20:

The limitations of claims 11 and 20 have already been discussed in the rejection of Claim 2. They are therefore rejected under the same rationale.

As per Claims 12 and 21:

The limitations of Claims 12 and 21 have already been discussed in the rejection of Claim 3. They are therefore rejected under the same rationale.

As per Claims 13 and 22:

The limitations of Claims 13 and 22 have already been discussed in the rejection of Claim 4. They are therefore rejected under the same rationale.

As per Claims 14 and 23:

The limitations of Claims 14 and 23 have already been discussed in the rejection of Claim 5. They are therefore rejected under the same rationale.

As per Claims 15 and 24:

The limitations of Claims15 and 24 have already been discussed in the rejection of Claim 6. They are therefore rejected under the same rationale.

As per Claims 16 and 25:

The limitations of Claims 16 and 25 have already been discussed in the rejection of Claim 7. They are therefore rejected under the same rationale.

As per Claims 17 and 26:

The limitations of Claims 17 and 26 have already been discussed in the rejection of Claim 8. They are therefore rejected under the same rationale.

As per claims 18 and 27:

The limitations of Claims 18 and 27 have already been discussed in the rejection of Claim 9. They are therefore rejected under the same rationale.

As per Claim 28:

Lymberopoulos discloses the steps of: (a) inputting shape and process conditions (anisotropy (shape of microscopic features etched into the wafer) and inputting plasma collision reaction data (page 474, right hand side column, last paragraph, lines 3-7); (c) computing electron density and temperature (electron density and temperature; page 481, left hand side column, a paragraph starting with "Combining Eq. (36) with..." lines 3-4) by a Monte Carlo method (page 475, right hand side column, a paragraph starting with " There are three kinds ..." line 9) and interpreting the transmission phenomenon of ion and neutral species (page 482, right hand side paragraph two lines 1-3) using the data of the steps (a) and (b) until they are converged (page 489, left hand side column, first paragraph, lines 14-15); and (d) obtaining overall plasma characteristics (plasma behavior; page 473, right hand side column, paragraph two line 11) using the converged values.

Lymberopoulos fails to disclose a method of simulating plasma in a plasma apparatus having a plasma reactor and a plurality of permanent magnets, which are asymmetrically arranged and rotate around the plasma reactor at predetermined speed and 3-dimensionally computing static magnetic fields induced by the permanent magnets.

Arami discloses a method of simulating plasma in a plasma apparatus having a plasma reactor and a plurality of permanent magnets, which are asymmetrically arranged (Fig. 13) and rotate around the plasma reactor (col. 6 lines 63-65) at predetermined speed (col. 8 lines 48-53).

Further, AOA discloses 3-dimensionally computing static magnetic fields induced by the permanent magnets (page 6 lines 27-31);

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to combine the teachings of Lymberopoulos related to computing plasma characteristics and generating of a generalized model of the plasma with the teachings of Arami

related to a plurality of magnets that move with respect to the reaction chamber and for each plurality of cross sections of the reaction chamber. The motivation for doing so would have been more convenient for generating a magnetic field having a magnetic line of force in the plasma generating area, so that the plasma of the process gas is generated in the plasma generating area (Abstract). Hence a skilled artisan having access to the teaching of Lymberopoulos and Arami would have knowingly modified the teaching of Lymberopoulos with Arami.

As per Claim 29:

Arami discloses plasma simulation at 2-dimensional cross-sections for cross-sectional magnetic field distribution in a characteristic magnetic field direction (Fig. 2, Fig 4).

As per Claim 30:

Lymberopoulos discloses 2-dimensional plasma simulation (page 487, left hand side column, last paragraph) is performed for a plurality of 2-dimensional cross-sections including an axis, obtains convergence values (page 489, left hand side column, first paragraph, lines 14-15) for the respective cross-sections, and averages them to obtain plasma characteristics (page 484, left hand side column, a paragraph starting with " The time average..." lines 1-3).

As per Claim 31:

Arami discloses DRM plasma apparatus (col. 1 lines 25-26).

As per Claim 32:

The limitation of claim 32 has already been discussed in the rejection of claim 28. It is therefore rejected under the same rationale.

As per Claim 33:

The limitation of claim 33 has already been discussed in the rejection of claim 29. It is therefore rejected under the same rationale.

As per Claim 34:

The limitation of claim 34 has already been discussed in the rejection of claim 30. It is therefore rejected under the same rationale.

As per Claim 35:

The limitation of claim 35 has already been discussed in the rejection of claim 31. It is therefore rejected under the same rationale.

Conclusion

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent No. 5,070,469 issued to Kunikiyo teaches simulating plasma for manufacturing semiconductors.

U.S. Patent No. 5,819,073 issued to Nakamura teaches simulating plasma for manufacturing semiconductors.

U.S. Patent No. 5,907,820 issued to Pan teaches simulating plasma for manufacturing semiconductors.

U.S. Patent No. 6,199,029 issued to Ohta teaches simulating plasma for manufacturing semiconductors.

6. Any inquiring concerning this communication or earlier communication from the examiner should be directed to Kibrom K. Gebresilassie whose telephone number is (571) 272-8571. The examiner can normally be reached on Monday-Friday, 8:30 am to 4:30 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner supervisor, Jean R. Homere can be reached at (571) 272-3780. The official fax number is (703) 872-9306. Any inquiring of a general nature relating to the status of this application should be directed to the group receptionist whose telephone number is (571) 272-3700.

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